

Corrosion Protection and Infrastructure Integrity – Agency Perspective

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I want to thank you for the opportunity to talk to you today about a very important issue facing North Slope operators and Alaska as a whole. I manage the Industry Preparedness and Pipeline Program for DEC, and as you can see from our Mission Statement, we “Assist Industry Keep the Oil in the Container”. We work closely with the oil industry across the state, from the exploration and production activities on the North Slope, to pipeline and tanker transportation systems, to refineries and fuel storage operations. Overall we work with about 140 regulated industry members in the state. Corrosion protection and infrastructure integrity is critical to this mission.

With just about 15 minutes to go through a very important topic, I’m just going to be able to hit a few of the key highlights. What I plan to outline today is: (1) who the regulators are, certainly DEC is not the only player, (2) I’ll take a few minutes to show what is happening in this issue in other parts of the state that have operated long before the oil industry was here, then (3) I’ll focus on North Slope issues, and (4) I’ll wrap up with some summary comments.

Who are the Regulators?

ADEC

Industry Preparedness and Pipeline Program

The Regulators



State & Federal Regulation for Pipeline and Related Facilities

- State of Alaska, Dept. of Envir. Conservation (ADEC)
- North Slope Borough (NSB)
- U.S. Dept. of Trans., Office of Pipeline Safety (RSPA/OPS)
- United States Coast Guard (USCG)
- U.S. Environmental Protection Agency (EPA)
- U.S. Dept. of Interior, Minerals Mgmt. Service (MMS)

As you can see, there are a number of local, state, and federal agencies that are involved with operations on the North Slope. Therefore there are a number of people who believe that corrosion protection and infrastructure integrity is an important issue.

I'm going to talk a little about the State of Alaska perspective. Alaska's focus is on Prevention. Thinking about prevention is a critical component of every project's inception. It must be in integral part of project planning through design, construction, and operation. All new facilities installed in Alaska must be installed to meet Best Available Technology (BAT), and must be managed using Best Management Practices (BMP). Although relatively new, North Slope facilities, as well as other facilities around the State, are beginning to show signs of wear after operating a short time in the hostile Arctic environment.

As indicated by our Mission Statement, our goal is to keep oil in the container, and not risk losing it to the environment. Clearly this is why corrosion protection and infrastructure integrity is a key issue for the successful operation of world class facilities. In terms of risk to the environment, we typically categorize the big risks in terms of pipeline leaks, tank leaks, and processing facility explosions. There are many lessons learned through the State. I would like to highlight some of these lessons to show the importance of corrosion protection and infrastructure integrity. When developing best practices, it is critical that North Slope operators evaluate the lessons learned from other industry members operating in Alaska. Since the North Slope facilities are relatively new, we do not expect to see many corrosion or infrastructure integrity issues at this point in time. But, as the facilities age over the next 50 plus years that they plan to operate in Alaska, this will be a growing issue.

So this is how I will begin my talk, with a few sobering pictures of significant, actual oil spill events that occurred in Alaska as a direct result of corrosion and infrastructure integrity issues. These are facilities that do not operate on the North Slope, but they can give you an idea of the impacts that an Arctic environment can have.

There are two basic approaches that operators can take relative to corrosion protection and infrastructure integrity. One is a reactive approach where we respond to a very large spill, certainly not the approach of choice. Or we could have a proactive approach where we mitigate the potential impacts; certainly a preferable choice.

Lets start with a reactive approach. Industry becomes "reactive" when it is unable to put in an effective prevention, inspection and monitoring system in place for detecting failures before they happen. This is a picture of a pipeline leak in Cook Inlet area.



1999 Pipeline Leak: Internal Corrosion

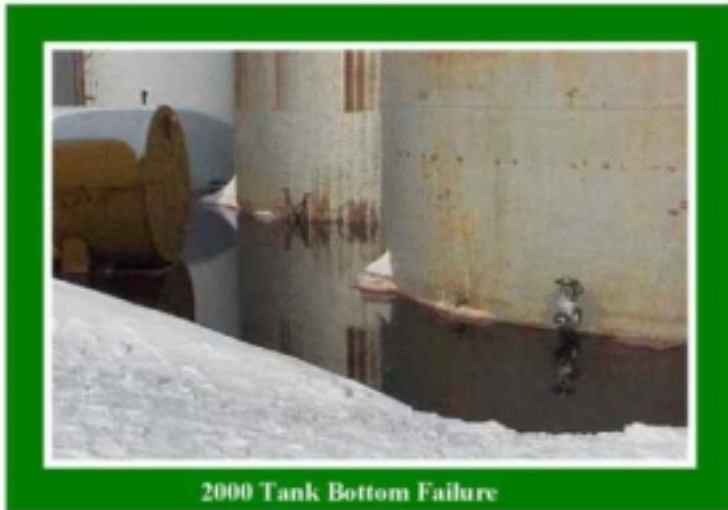
You can see the oil and water pooling up around the snow. About 134,000 gallons of oil and water leaked from a four to six inch buried gathering line. Here is a picture of the line once it was excavated.



1999 Pipeline Leak: Internal Corrosion

There was a 3/8 inch hole found in the pipe. This hole was caused by internal corrosion. A routine program of monitoring, inspection and repair could have prevented this spill.

Here is another example, and a more recent one, from a tank farm in a remote Arctic location. The bottom of the tank completely failed, releasing 8500 gallons of aviation gasoline.



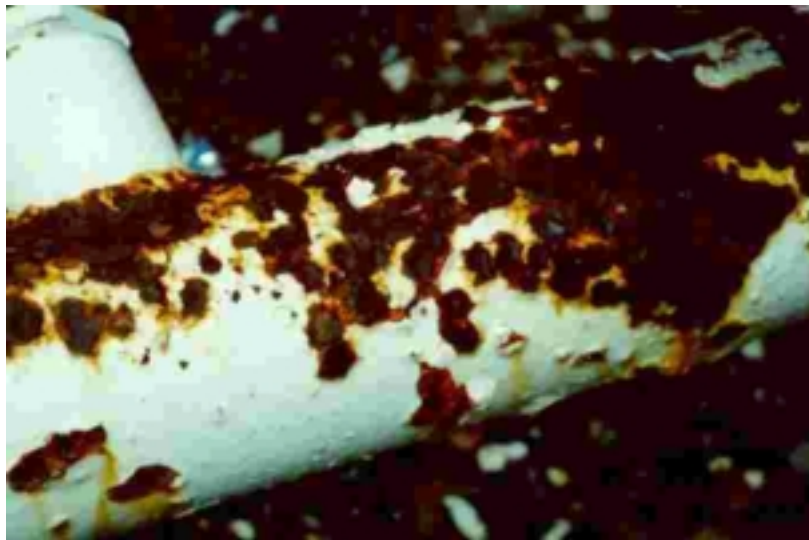
Luckily, the tank leaked into a secondary containment area, but it leaked very fast. In about 30 minutes the whole contents of the tank got away, so there wasn't a whole lot of time to react. Once again, a program of routine inspection and repair could have avoided this spill.

Since we inspect facilities throughout the state, I thought I

would show you a few other pictures of some of our recent inspections in order to help you visualize the extent to which the Arctic environment can impact an Alaskan facility. This is a picture of a pipeline with severe external corrosion

The winters here are very hard on facilities, and we must work very diligently to keep them protected.

Here is another picture from a remote facility that has been in Alaska for a very, very long time





The importance of this picture is to show you the detrimental effects permafrost. As you move north further in Alaska, permafrost is a very tough thing to deal with. The North Slope operators have successfully dealt with it for a long time, but it is an issue across the state that takes careful planning and design. These tanks were clearly not designed with permafrost issues in mind. The photo clearly depicts the settling

effects after years of having hot tanks sitting on cold permafrost

From the proactive side, one of the most important lessons that North Slope operators can learn from other industry experience around the state is that after operating for a number of years in the harsh Arctic environment, it really takes its toll on facilities. Most operators in state have been driven to upgrade or replace substantial portions of their facilities because it is just good business. It is sometimes it is more cost effective to make a capital investment in terms of a repair or replacement, than it is to pay the high chemical treatment cost, or the high cost of more frequent inspection or monitoring, or worse. Yet the extreme high cost of cleaning up oil spill or remediation of environmental damage.

Over the last ten years as the result of Alaska's tougher oil spill prevention and response regulations, a number of facilities across the state have undertaken significant upgrades in terms of repairs and replacement.



In this picture, you see a tank farm with fully upgraded tanks with secondary containment. Clearly we don't see anything like this up on the North Slope because they have installed their facilities to an industry standard above this. But it clearly shows the effects of what our program has done in terms of really keeping a watchful eye on industry and ensuring that facilities either install them

correctly in the first place, or they upgrade them. In the next picture you see an older tank farm that was fully upgraded.



The last picture is of an upgraded pipeline facility.

So now let's move to the North Slope. Now that we've had the opportunity to see some of the challenges that have been faced by other well-established industries around the state, we can now compare and contrast them with the North Slope. The North Slope infrastructure is relatively new. The facilities at Prudhoe were built in 1977, and many fields have come thereafter. The oldest oil facilities in the State are located in Cook Inlet. Many of the Cook Inlet facilities were built in the 1950s and 60s. Thinking about prevention must begin at project inception. Prevention must be an integral part of the project through planning, design, construction, and operation, and the North Slope facilities were definitely built with state-of-the-art technology. We are also pleased to see that North Slope operators have been continuing their commitment by instituting corrosion inspection and maintenance programs at their facilities that Belinda will be talking to you about next. .



Overall, the facilities are well maintained, and North Slope management is committed to running a world-class operation. Alaska has over 950 miles of crude oil transportation lines, with a capacity of over nine million gallons. There are 800 miles of gathering lines, with a capacity of over 750,000 barrels. There are over 19 miles of refined product transportation pipelines with a capacity of over 41,000 barrels. Most of this infrastructure resides on the North Slope, or supports North Slope operations like TAPS. So clearly if we are going to make an impact on corrosion protection and infrastructure integrity, we will be focusing our energy on the North Slope.

Even with the most aggressive programs, it is clear that across the state Arctic conditions accelerate aging and corrosion processes. Although relatively new, North Slope facilities as well as others around the State are starting to show signs of wear after operating for a short time. Increased vigilance is warranted.

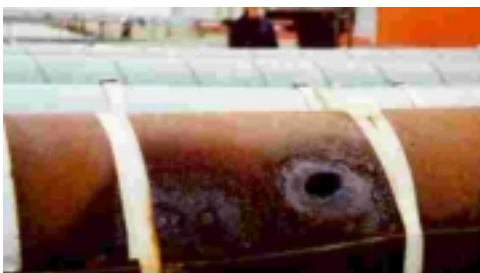
I'll show you a few more pictures. In our inspections, as we start to move along the edges of the field, we are definitely starting to see the signs of aging on North Slope facilities. This is a picture of a pipeline that was recently taken by one of our inspectors that shows that many of the pipelines are starting to sag and have structural integrity problems. These pipelines are no longer properly supported, and could potentially pose a spill risk.



Here is another picture of a pipeline. Up on the North Slope internal corrosion is quite a problem, due to water damage to the insulation. Here is a pipeline that has had an internal corrosion problem, we see that the insulation has been taken off the pipeline so that we can further examine that problem. We also see some problems with pipeline supports.

Corrosion is a common problem with tanks. This

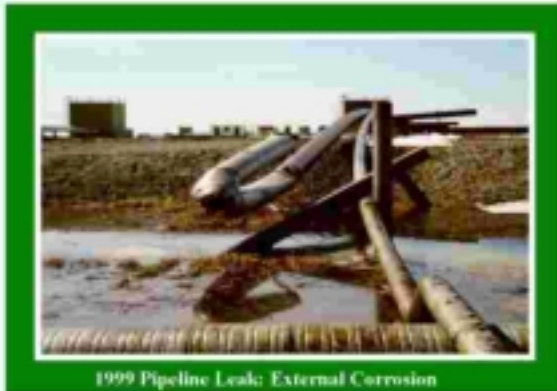
is a picture of a tank where there is significant corrosion at the base. There are thousands of barrels of oil and hazardous materials stored in tanks across the North Slope. Upon close inspection, we are starting to see some problems, and are working closely with industry to make sure that there are remedies.



Here is another picture of a pipeline that has such severe internal and external corrosion that a hole has been eroded right through the pipe. From the DEC database, our data show that about 75% of the spills that have occurred on the North Slope to date have been attributed to structural or mechanical failures, so there is a direct link between reducing spills and infrastructure integrity.

Corrosion rates are affected by environmental factors: temperature, velocity of the material through the container, maturity, contact with exposure time, and stress. Corrosion detection and monitoring programs are key. Industry must establish where

corrosion is occurring, and detect changes in corrosive conditions. Corrosion control is not only a critical safety issue, it is an environmental-impact issue, and is just good business.

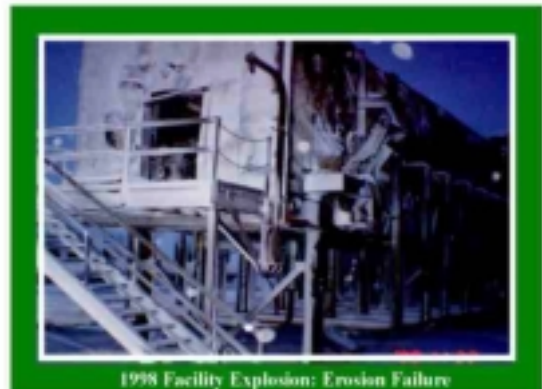


1999 Pipeline Leak: External Corrosion

Recently the North Slope has had a few severe corrosion-related incidents that have increased the awareness of both industry and regulators. This is a picture of a North Slope pipeline leak. A flow line broke due to external corrosion under the insulation. As you can see in the picture, the incident resulted in a complete severing of the line. You can see that the pipeline crimped back upon itself about 10 feet, preventing the wellhead casing system from activating properly and

automatically shutting in the well. Approximately 1700 gallons of oil sprayed out across the pad.

Here is a picture of another corrosion and infrastructure integrity problem. Erosion caused the failure of a pipe component in a production module, resulting in the release of gas. The gas found an ignition source and resulted in a large explosion. As you can see, this facility completely exploded. The photo is very dark due to the winter season and lack of light; however, you can see that the explosion was so significant that the module walls were ripped off. This is a picture of the offending pipe.



1998 Facility Explosion: Erosion Failure



1998 Facility Explosion: Erosion Failure

The pipe was eroded and that is where the gas leak had occurred from, resulting in the explosion. I have shown you a few of these pictures just to give you an idea of why it is good business from the severity of the issues, and why it requires increased vigilance.

So in summary, I'd like to go through just a few highlights.

- North Slope facilities are relatively new, but are beginning to show the signs of aging, as will occur in any industry.
- North Slope facilities are unique in that they operate in a very hostile Arctic environment, unlike oilfield facilities in the lower 48.
- There are many lessons to be learned from other facilities that have operated for in Alaska for a number of years in the same type of Arctic conditions. We've seen these problems before, we know they exist, and we know the solutions to the problems.
- Maintaining a "world class" oil field requires vigilance: protection, inspection and monitoring, repair and replacement are vital.
- Declining revenues in industry and in government is a primary driver of complacency. With complacency comes the loss of vigilance, and we definitely don't want to be in that position.

Thank you, again, for the opportunity to talk to you today about this important issue to the State of Alaska.